

**REMARKS**

Upon entry of the instant amendment, claims 1-5 and 7 will remain pending in the present application and stand ready for further action on the merits.

In the instant amendment the specification and claims have been amended as explained below.

*Amendments to the specification*

The specification has been amended as follows:

- (1) Page 13, lines 18-19: changed “and European Patent No. 10166448 B1” to --(corresponding to European Patent No. 1016648 B1)--.
- (2) Page 16, line 19: deleted “224,”.
- (3) Page 17, line 1: changed “127” to --126--.
- (4) Page 49, line 10: changed “MPC synthesis” to --DPC synthesis--.
- (5) Page 49, line 13: changed “MPC synthesis” to --DPC synthesis--.
- (6) Page 49, line 16: changed “MPC synthesis” to --DPC synthesis--.

Amendment (1) has been made for purposes of correcting an erroneously described number of a patent document and giving an exact correspondence between patents documents. Specifically, an EP patent is described as “European Patent No. 10166448 B1” at page 13, line 19 of the present specification. However, there is no EP patent having the number “10166448 B1”. The EP patent referred to as “European Patent No. 10166448 B1” should correctly be referred to as “European Patent No. 1016648 B1” (EP1016648 B1), and this correct European Patent No. 1016648 B1 (EP1016648 B1) corresponds to Unexamined Japanese Patent

Application Laid-Open Specification No. Hei 11-92429 (JP11-92429) described at page 13, lines 17-18 of the present specification.

As a support for this amendment, the Applicants submit, as Exhibit 1, a document titled “esp@cenet Family list view”, downloaded from the website of the European Patent Office, which shows that EP1016648 B1 corresponds to JP11-92429.

Amendment (2) is made for deleting an unnecessary reference numeral. Specifically, reference numeral “224” is used as a reference numeral indicating a conduit at page 16, line 19 of the present specification. However, reference numeral “224” is never used in the drawings of the present application. Therefore, reference numeral “224” should be deleted.

Amendment (3) is made for correcting an erroneously described reference numeral. Specifically, reference numeral “127” is used as a reference numeral indicating a condenser at page 17, line 1 of the present specification. However, in Figs. 1 and 2 of the present application, reference numeral “127” does not indicate a condenser but a conduit, and, instead of reference numeral “127”, reference numeral “126” is used for indicating a condenser. Therefore, reference numeral “127” should be changed to “126” as a reference numeral indicating a condenser.

Each of Amendments (4) and (5) is made for correcting an inadvertent typographical error. Support for this amendment is found, for example, in Example 1 of the present application (*see page 52, line 3 to page 58, line 3 of the present specification*).

Amendment (6) is made for correcting an inadvertent typographical error. Support for this amendment is found, for example, in Example 2 of the present application (*see page 58, line 23 to page 60, line 20 of the present specification*).

Amendments to the claims

Claim 6 has been canceled.

Claim 7 has been redrafted as a process claim; amended claim 7 is directed to a process for producing an aromatic polycarbonate, which involves the process of claim 1.

Accordingly, the instant amendments to the specification and claims do not incorporate new matter into the application as originally filed.

***Claim Rejection under 35 U.S.C. § 112***

Claims 1-7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite on the ground that “Claims 1-7 recite the definition of an aromatic carbonate; however, there is no chemical formula for this material” (*see page 2, lines 9-5 from bottom of the Office Action*). The Applicants disagree with the Examiner and wish to traverse as follows.

The Examiner’s attention is drawn to step (I) of claim 1, which defines an aromatic carbonate by a chemical formula. Specifically, step (I) of claim 1 recites “at least one aromatic carbonate (a)” selected from the group consisting of an alkyl aryl carbonate represented by the formula (5) (ROCOOAr) and a diaryl carbonate represented by the formula (6) (ArOCOOAr). It should be noted that claim 1 is directed to a process for producing the “at least one aromatic carbonate (a)” in high purity. Thus, claim 1 is definite.

The remaining claims, *i.e.*, claims 2-5 and 7 are also definite.

Claim 7 is also rejected under 35 U.S.C. 112, second paragraph, on the ground that the terms “aromatic polycarbonate” and “aromatic dihydroxy compound” are indefinite (*see page 3, lines 1-2 of the Office Action*). The Applicants disagree with the Examiner and wish to traverse as follows.

At the outset, it should be noted that claim 7 has been amended. Amended claim 7 reads as follows:

7. A process for producing an aromatic polycarbonate, which comprises producing an aromatic carbonate by the process of claim 1 and subjecting an aromatic dihydroxy compound and the aromatic carbonate to a transesterification reaction.

The aromatic dihydroxy compound recited in amended claim 7 is reacted with the aromatic carbonate produced by the process of claim 1. As explained above, the aromatic carbonate produced by the process of claim 1 is clearly defined by a chemical formula (*i.e.*, the formula (5) (ROCOOAr) or the formula (6) (ArOCOOAr)). Therefore, the aromatic dihydroxy compound recited in amended claim 7 is definite as an aromatic dihydroxy compound which can be reacted with the aromatic carbonate produced by the process of claim 1.

When the aromatic dihydroxy compound and the aromatic carbonate have been definite, the aromatic polycarbonate recited in amended claim 7 also becomes definite as an aromatic polycarbonate which is produced by subjecting the aromatic dihydroxy compound and the aromatic carbonate to a transesterification reaction.

The working Examples of the present application use bisphenol A as an aromatic dihydroxy compound for the production of an aromatic polycarbonate (see, for example, Example 5 appearing at page 62, line 13 to page 63, line 6 of the present specification). In this connection, it should be noted that there are known a number of aromatic dihydroxy compounds other than bisphenol A and a number of aromatic polycarbonates produced using these aromatic dihydroxy compounds. As a document showing a number of aromatic dihydroxy compounds of

bisphenol type and a number of aromatic polycarbonates produced using these aromatic dihydroxy compounds, the Applicants submit herewith the following document as **Exhibit 2**: Encyclopedia of Polymer Science and Engineering, Vol. 11, pages 682-687 (1988) (published by John Wiley & Sons, Inc.). **Table 10** of this document shows a number of aromatic dihydroxy compounds of bisphenol type and industrially useful aromatic polycarbonates produced using these aromatic dihydroxy compounds.

***COMMENTS ON THE STATE OF THE ART AND THE ESSENTIAL FEATURES  
AND ADVANTAGES OF THE PRESENT INVENTION***

Before specifically addressing the Examiner's rejections of the claims over the references, it is believed that the following background information should be considered in order to shed a proper light on the development of the present invention and the essential features and advantages thereof.

As described in the present specification, an aromatic carbonate is useful as a raw material for producing an aromatic polycarbonate (whose utility as engineering plastics has been increasing in recent years) by a transesterification reaction without using poisonous phosgene (*see page 2, lines 4-19 of the present specification*).

However, heretofore, there has not been known any process which can be used for efficiently producing a high purity aromatic carbonate which exhibits advantageously high reactivity when used as a raw material for a transesterification aromatic polycarbonate and, hence, it has been desired to develop such a process (*see page 9, lines 10-15 of the present specification*).

In this situation, the present inventors have made extensive and intensive studies. In their studies, the present inventors have unexpectedly found that a specific aromatic carbonate ether is contained in an aromatic carbonate produced by a conventional transesterification process and that the problems accompanying the prior art can be solved by a process involving a step for separating the aromatic carbonate ether. This is explained in the present specification as follows:

“[0014] For solving the above-mentioned problems, the present inventors have made extensive and intensive studies. As a result, they have unexpectedly found that a specific aromatic carbonate ether is contained in an aromatic carbonate produced by a process comprising transesterifying a starting material selected from the group consisting of a dialkyl carbonate, an alkyl aryl carbonate and a mixture thereof with a reactant selected from the group consisting of an aromatic monohydroxy compound, an alkyl aryl carbonate and a mixture thereof, in the presence of a catalyst, to thereby obtain a high boiling point reaction mixture comprising a desired aromatic carbonate, while withdrawing a low boiling point reaction mixture containing a low boiling point by-product. Further, they have also found that, when an aromatic carbonate containing a large amount of the above-mentioned specific aromatic carbonate ether is used as a raw material for producing a transesterification aromatic polycarbonate, the polymerization reactivity of the aromatic carbonate is lowered and the resultant aromatic polycarbonate is discolored, and that, by separating and removing the aromatic carbonate ether from the reaction system for producing an aromatic carbonate to thereby reduce the aromatic carbonate ether content of an aromatic carbonate, it becomes possible to obtain an aromatic carbonate having a high transparency, which exhibits high polymerization reactivity when used as a raw material for an aromatic polycarbonate. The present invention has been completed, based on these novel findings.” (emphasis added) (see page 14, line 7 to page 15, line 11 of the present specification)

As seen from the above-reproduced passage of the present specification, the present inventors have found:

that a specific aromatic carbonate ether as recited in claim 1 is contained in an aromatic carbonate produced by a conventional transesterification process;

that, when an aromatic carbonate containing a large amount of the aromatic carbonate ether is used as a raw material for producing a transesterification aromatic polycarbonate, the aromatic polycarbonate produced is discolored; and

that, when an aromatic carbonate having a reduced content of the aromatic carbonate ether is used as a raw material for producing a transesterification aromatic polycarbonate, the aromatic polycarbonate produced has excellent color and high molecular weight.

It should be emphasized that the above-mentioned facts, *i.e.*, the presence of the aromatic carbonate ether in an aromatic carbonate, the discoloration of an aromatic polycarbonate due to it, and the production of an excellent aromatic polycarbonate by the use of an aromatic carbonate having a reduced content of the aromatic carbonate ether, have for the first time been found by the present inventors. Based on these findings, the present invention has been completed.

As defined in claim 1 of the present application, the process of the present invention comprises the steps of:

(I) transesterifying a starting material selected from the group consisting of a dialkyl carbonate, an alkyl aryl carbonate and a mixture thereof with a reactant selected from the group consisting of an aromatic monohydroxy compound, an alkyl aryl carbonate and a mixture thereof, in the presence of a catalyst, to thereby obtain a high boiling point reaction mixture comprising at least one aromatic carbonate (a) and a specific aromatic carbonate ether (b), while withdrawing a low boiling point reaction mixture, and

(II) separating the aromatic carbonate ether (b) from the high boiling point reaction mixture to thereby obtain a high purity aromatic carbonate.

It is essential for the process of the present invention to involve a step (*i.e.*, step (II)) for separating a specific aromatic carbonate ether (b) from a reaction mixture containing a desired aromatic carbonate. By performing such a separation step, the aromatic carbonate obtained by the process of the present invention has a reduced content of the aromatic carbonate ether (b) and can be advantageously used for producing an aromatic polycarbonate having excellent color and high molecular weight.

The effects of the present invention are summarized in the present specification as follows:

“Industrial Applicability

[0111] In the aromatic carbonate produced by the process of the present invention, the content of an aromatic carbonate ether (which is a conventionally unknown impurity and has a harmful influence on the reactivity of an aromatic carbonate) is reduced. The aromatic carbonate obtained by the process of the present invention has a high purity and exhibits high polymerization reactivity when used as a raw material for a polycarbonate, so that the aromatic carbonate is useful as a raw material for a transesterification aromatic polycarbonate.” (*see page 65, lines 1-12 of the present specification*)

The effects of the present invention are substantiated by the working examples of the present application.



***Rejection of claim 6 or 7 under 35 U.S.C. § 102(b)***

Claim 6 is rejected under 35 U.S.C. 102(b) as being anticipated by **Gomberg et al.**, J. Am. Chem. Soc. 1925, 47, 198-211 (*see page 3 of the Office Action*). This rejection is rendered moot by the cancellation of claim 6 herein, such that withdraw of the rejection is required at present.

Claim 7 is also rejected under 35 U.S.C. 102(b) as being anticipated by **Miyamoto et al.** (US 2003/0166826) or the like (*see pages 3-4 of the Office Action*). This rejection should be moot by the instant amendment to claim 7. Specifically, amended claim 7 is directed to a process involving the process of claim 1. Since claim 1 is not anticipated by **Miyamoto et al.** or the like, amended claim 7 is also not anticipated by **Miyamoto et al.** or the like.

***Claim Rejection under 35 U.S.C. 103(a)***

Claims 1-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,210,268 (hereinafter referred to as “**Fukuoka et al.**”) (*see pages 4-6 of the Office Action*).

Claims 1-7 are also rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,262,210 (hereinafter referred to as “**Tojo et al.**”) in view of **Fukuoka et al.** (*see pages 6-7 of the Office Action*).

Each of the above rejections is respectfully traversed, and reconsideration and withdraw thereof are respectfully requested based on the following considerations.

**Fukuoka et al.** and **Tojo et al.** disclose a process for producing an aromatic carbonate by transesterification reaction. However, neither **Fukuoka et al.** nor **Tojo et al.** have any teaching or suggestion about the facts which have for the first time been found by the present inventors,

*i.e.*, the presence of the aromatic carbonate ether (b) in an aromatic carbonate, the discoloration of an aromatic polycarbonate due to it, and the production of an excellent aromatic polycarbonate by the use of an aromatic carbonate having a reduced content of the aromatic carbonate ether (b). Further, neither **Fukuoka et al.** nor **Tojo et al.** have any teaching or suggestion about the step (II) of the process of the present invention, *i.e.*, a step for separating the aromatic carbonate ether (b). With respect to the disclosure of the references, a detailed explanation is given below.

***Fukuoka et al. do not teach or suggest the process of the present invention***

The Examiner correctly recognizes that **Fukuoka et al.** do not teach the identity of the impurity, *i.e.*, the aromatic carbonate ether (b), recited in claim 1 of the present application and that **Fukuoka et al.** do not teach a procedure for separating the impurity (*see page 4, line 2 from bottom to page 5, line 2 of the Office Action*). However, in spite of this correct recognition, the Examiner takes the position that the process of the present invention is obvious over **Fukuoka et al.** Specifically, the Examiner states as follows:

“ With respect to the difference that the prior art does not teach the identity of the impurity instantly noted as an aromatic carbonate ether, the fact that Applicant has identified an impurity present does not render the process novel or unobvious. This same impurity would have been present in the process reported by Fukuoka et al. given the similar procedure used. Therefore, the presence of the impurity instantly noted as an aromatic carbonate ether is implicit in the procedure taught by Fukuoka et al.

With respect to the difference that the prior art does not teach a procedure for a distillation to remove said impurity, Fukuoka et al. teach (column 24) that the high boiling point reaction mixture may contain by-products and that these by-products could be removed by subjecting the mixture to the “conventional method for separation and purification, such as distillation, crystallization and the

like, to thereby isolate the desired aromatic carbonate.” Therefore, a person having ordinary skill in the art at the time the invention was made would have been motivated to distill the product obtained from the procedure taught by Fukuoka et al. in order to obtain a high-purity aromatic carbonate.” (*see page 5, lines 6-22 of the Office Action*)

The Examiner’s position is traversed as follows.

The high boiling point reaction mixture recited in **Fukuoka et al.** may actually contain the aromatic carbonate ether (b) recited in claim 1 of the present application. However, **Fukuoka et al.** do not teach or suggest any procedure for separating the aromatic carbonate ether (b) from the high boiling point reaction mixture. The reason is as follows.

For performing a procedure for separating the aromatic carbonate ether (b), it is necessary to know the properties of the aromatic carbonate ether (b). However, as the Examiner recognizes, **Fukuoka et al.** do not teach the identity of the aromatic carbonate ether (b), let alone the properties of the aromatic carbonate ether (b). Therefore, a person skilled in the art would not have been able to obtain from **Fukuoka et al.** any teaching or suggestion about performing a procedure for separating the aromatic carbonate ether (b).

A portion of **Fukuoka et al.**, containing the Examiner’s cited portion, is reproduced below:

“In the process of the present invention, the high boiling point reaction mixture containing the desired aromatic carbonate which is withdrawn from the lower portion of the continuous multi-stage distillation column, can be subjected to the conventional method for separation and purification, such as distillation, crystallization and the like, to thereby isolate the desired aromatic carbonate.” (*see column 24, lines 60-67 of Fukuoka et al.*)

The above-reproduced description of **Fukuoka et al.** only states that the high boiling point reaction mixture containing the desired aromatic carbonate can be subjected to separation and purification so as to increase the purity of the aromatic carbonate. This description does not teach or suggest any specific procedure for the separation of the aromatic carbonate ether (b).

Further, **Fukuoka et al.** have no teaching or suggestion about the effects of the present invention.

Thus, it is apparent that **Fukuoka et al.** have no teaching or suggestion about the process of claim 1 of the present application. It is also apparent that none of the remaining claims, including amended claim 7 directed to a process involving the process of claim 1, is taught or suggested by **Fukuoka et al.**

***Tojo et al. do not teach or suggest the process of the present invention***

**Tojo et al.** disclose a process for producing an aromatic carbonate, which comprises transesterifying, in the presence of a metal-containing catalyst, a starting material selected from the group consisting of a dialkyl carbonate, an alkyl aryl carbonate and a mixture thereof with a reactant selected from the group consisting of an aromatic monohydroxy compound, an alkyl aryl carbonate and a mixture thereof (*see column 6, lines 19-26 of Tojo et al.*).

In the process of **Tojo et al.**, a high boiling point reaction mixture is obtained by the transesterification reaction. This high boiling point reaction mixture contains the desired aromatic carbonate and a high boiling point substance (A) having a boiling point higher than the aromatic carbonate. For easy reference, a relevant description of **Tojo et al.** is reproduced below:

“at least one type of catalyst-containing liquid is taken out, the catalyst-containing liquid being selected from the group consisting of a portion of a high boiling point reaction mixture obtained by the above transesterification and containing the desired aromatic carbonate and a metal-containing catalyst, and a portion of a liquid catalyst fraction obtained by separating the desired aromatic carbonate from the high boiling point reaction mixture, wherein each portion containing high boiling point substance (A) having a boiling point higher than the boiling point of the produced aromatic carbonate and containing the metal-containing catalyst (B);

a functional substance (C) capable of reacting with at least one component selected from the group consisting of the high boiling point substance (A) and the metal-containing catalyst (B) is added to the taken-out catalyst-containing liquid, to thereby obtain at least one reaction product selected from the group consisting of an reaction product (A)/(C) and a reaction product (B)/(C);

and the reaction product (B)/(C) is recycled to the reaction system directly or indirectly, while withdrawing the high boiling point substance without withdrawing the catalyst from the reaction system,” (emphasis added) (*see column 6, lines 29-52 of Tojo et al.*)

The high boiling point substance (A) recited in **Tojo et al.** is different from the aromatic carbonate ether (b) recited in claim 1 of the present application. On this point, a detailed explanation is given below.

The high boiling point substance (A) recited in **Tojo et al.** has a boiling point higher than the aromatic carbonate produced.

On the other hand, the aromatic carbonate ether (b) recited in claim 1 of the present application usually has a boiling point lower than the aromatic carbonate produced. This is apparent, for example, from Example 1 of the present application. Specifically, in Example 1 of the present application, the aromatic carbonate ether (b) is withdrawn from top 202 of continuous multi-stage distillation column 201, and diphenyl carbonate as the aromatic carbonate is

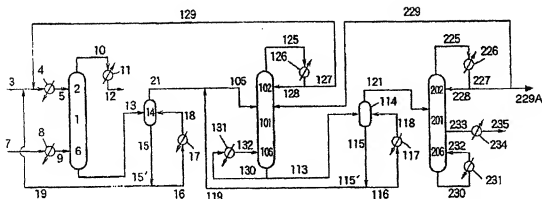
withdrawn from continuous multi-stage distillation column 201 through conduit 233 positioned at a middle portion of continuous multi-stage distillation column 201.

For easy reference, relevant descriptions of the present specification and Fig. 1 of the present application are reproduced below:

“[0097] The gas formed in evaporator 114 was fed through conduit 121 into continuous multi-stage distillation column 201 at a position of 2.0 m below top 202 thereof, which column was comprised of a plate column having a height of 6 m and a diameter of 6 inches and provided with 20 sieve trays. In column 201, diphenyl carbonate was separated from the gas. Continuous multi-stage distillation column 201 was operated under conditions wherein the temperature at the column bottom was 184 °C and the pressure at the column top was  $2 \times 10^3$  Pa. Gas distilled from top 202 of the column was led through conduit 225 to condenser 226, in which the gas was condensed. A part of the resultant condensate was recycled to top 202 of the column through conduit 228, another part of the condensate was recycled to continuous multi-stage distillation column 101 through conduits 227 and 229, and the remainder of the condensate was withdrawn through nozzle 229A provided on conduit 229 at a rate of 0.05 kg/hr. A gas was withdrawn from continuous multi-stage distillation column 201 through conduit 233 provided at a position of 4 m below column top 202 and was led to condenser 234, in which the withdrawn gas was condensed. The resultant condensate was withdrawn at a rate of 6.7 kg/hr through conduit 235.” (emphasis added) (see page 56, line 20 to page 57, line 19 of the present specification)

“[0098] When the operation reached a stationary state, various analyses were performed. As a result, it was found that the condensate withdrawn from nozzle 229A contained 9.2 % by weight of an aromatic carbonate ether ( $\text{CH}_3\text{OCH}_2\text{CH}_2\text{OCOOPh}$ ), and that the condensate withdrawn from conduit 235 contained 99.99 % by weight or more of diphenyl carbonate, wherein the concentration of the aromatic carbonate ether ( $\text{CH}_3\text{OCH}_2\text{CH}_2\text{OCOOPh}$ ) in the condensate was 5 ppm by weight.” (emphasis added) (see page 57, line 20 to page 58, line 3 of the present specification)

FIG 1



Thus, it is apparent that the high boiling point substance (A) recited in **Tojo et al.** is different from the aromatic carbonate ether (b) recited in claim 1 of the present application.

As explained above, the process of the present invention involves a step (*i.e.*, step (II)) for separating the aromatic carbonate ether (b). When step (II) is not performed, the aromatic carbonate obtained has a large content of the aromatic carbonate ether (b).

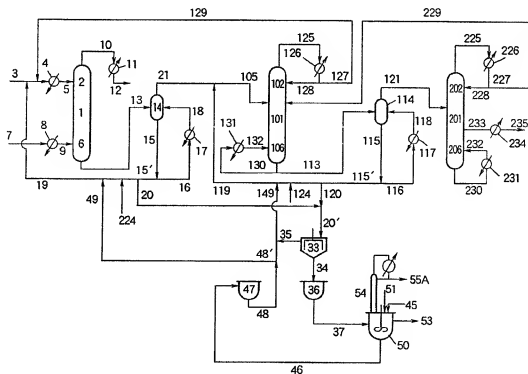
In this connection, it should be noted that the process of **Tojo et al.** is similar to the process performed in Comparative Example 1 of the present application. On this point, a detailed explanation is given below, with reference to Example 3 of **Tojo et al.**

In Example 3 of **Tojo et al.**, gas distilled from top 202 of continuous multi-stage distillation column 201 is recycled to continuous multi-stage distillation column 101. For easy reference, a relevant description of the specification of **Tojo et al.** and Fig. 3 of **Tojo et al.** are reproduced below:

"An evaporated gas formed in evaporator 114 was fed through conduit 121 into continuous multi-stage distillation column 201 at a position of 2.0 m below top 202 thereof, which column was comprised of a plate column having a height of 6

m and a diameter of 6 inches and provided with 20 sieve trays, thereby separating DPC from the fed gas. Continuous multi-stage distillation column 201 was operated under conditions such that the temperature at the column bottom was 184 °C and the pressure at the column and top was  $2 \times 10^3$  Pa. Gas distilled from top 202 of the column was led through conduit 225 to condenser 226, in which the gas was condensed. A portion of the resultant condensate was recycled into top 202 of the column through conduit 228, and the remainder of the condensate was recycled into continuous multi-stage distillation column 101 through conduits 227 and 229." (see column 54, lines 24-39 of Tojo et al.)

FIG. 3



It should be noted that the process of Example 3 of Tojo et al. does not involve an operation for removing from the system a part of the gas distilled from top 202 of continuous multi-stage distillation column 201.



The process of Comparative Example 1 performed in the present application is similar to Example 3 of **Tojo et al.** in that the process of Comparative Example 1 of the present application does not involve an operation for removing from the system a part of the gas distilled from top 202 of continuous multi-stage distillation column 201. For easy reference, a relevant description of the present specification is reproduced below:

“[0099] [Comparative Example 1]

Diphenyl carbonate was produced in substantially the same manner as in Example 1, except that the withdrawal of the condensate from nozzle 229A was not performed. When the operation reached a stationary state, various analyses were performed. As a result, it was found that the condensate withdrawn from conduit 235 contained 99.90 % by weight to less than 99.99 % by weight of diphenyl carbonate, wherein the concentration of an aromatic carbonate ether ( $\text{CH}_3\text{OCH}_2\text{CH}_2\text{OCOOPh}$ ) in the condensate was 68 ppm by weight.” (emphasis added) (*see page 58, lines 5-15 of the present specification*)

Due to lack of a procedure for the separation of the aromatic carbonate ether (b), the aromatic carbonate produced in Comparative Example 1 of the present application or by the process of **Tojo et al.** has a larger content of the aromatic carbonate ether (b) than the aromatic carbonate produced by the process of the present invention. In other words, the aromatic carbonate produced by the process of the present invention is superior to the aromatic carbonate produced in Comparative Example 1 of the present application or by the process of **Tojo et al.** in that the aromatic carbonate produced by the process of the present invention has a lower content of the aromatic carbonate ether (b) than the aromatic carbonate produced in Comparative Example 1 of the present application or by the process of **Tojo et al.** This is apparent from the following description of the present specification:

“The results of Example 1 and this Comparative Example 1 show that the purity of the diphenyl carbonate obtained is improved when, as in Example 1, a part of a column top reaction mixture containing an aromatic carbonate ether is withdrawn from continuous multi-stage distillation column 201.” *(see page 58, lines 15-21 of the present specification)*

In this connection, it should be noted that the content of the aromatic carbonate ether (b) in the aromatic carbonate produced in Example 1 of the present application is as low as 5 ppm by weight *(see page 58, lines 1-3 of the present specification)*, whereas the content of the aromatic carbonate ether (b) in the aromatic carbonate produced in Comparative Example 1 of the present application is as high as 68 ppm by weight *(see page 58, lines 13-15 of the present specification)*.

From the above, it is apparent that **Tojo et al.** do not teach or suggest the process of the present invention.

It is also apparent that **Fukuoka et al.** and **Tojo et al.** do not teach or suggest the process of the present invention, even if taken in combination.

#### ***Obviousness-type double patenting rejection***

Claims 1-5 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of **Fukuoka et al.** *(see pages 7-8 of the Office Action)*. It is believed that this rejection has already been overcome by the above argument against the obviousness rejection of the claims over **Fukuoka et al.** In this regard, patentable distinctions exist between the instant claims and the disclosure of **Fukuoka et al.**, such that the outstanding obviousness-type double patenting rejection must be reconsidered at present.

### CONCLUSION

Based upon the amendments and remarks presented herein, the Examiner is respectfully requested to issue a Notice of Allowance clearly indicating that each of the pending claims 1-5 and 7 is allowable under the provisions of Title 35 of the United States Code.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact John W. Bailey, Reg. No. 32,881 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

Dated: October 21, 2009

Respectfully submitted,

By 

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Attachments: **Exhibit 1:** "esp@cenet Family list view" of JP11-92429 (2 pages)  
**Exhibit 2:** Encyclopedia of Polymer Science and Engineering, Vol. 11, pages 682-687 (1988) (8 pages)

## Exhibit 1

## Family list

14 family members for: JP11092429

Derived from 10 applications



- 1 PROCESS FOR THE PREPARATION OF AROMATIC CARBONATES  
 Inventor: OONISHI KAZUHIRO (JP); KOMIYA KYOSUKE (JP); (+1)  
 EC: C07C68/06  
 Publication info: CA2294114 A1 - 1999-03-25  
 CA2294114 C - 2004-05-25  
 Applicant: ASAHI CHEMICAL IND (JP)  
 IPC: B01J23/14; C07B61/00; C07C68/06 (+9)
- 2 Process for preparation of aromatic carbonates  
 Inventor: MASAHIRO TOJO (JP); KYOSUKE OONISHI KAZUHIRO KOMIY (JP)  
 EC: C07C68/06  
 Publication info: CN1111152C C - 2003-06-11  
 CN1265641 A - 2000-09-06  
 Applicant: ASAHI CHEMICAL IND (JP)  
 IPC: B01J23/14; C07B61/00; C07C68/06 (+8)
- 3 PROCESS FOR THE PREPARATION OF AROMATIC CARBONATES  
 Inventor: TOJO MASAHIRO (JP); OONISHI KAZUHIRO (JP); (+1)  
 EC: C07C68/06  
 Publication info: DE69814652D D1 - 2003-06-18  
 Applicant: ASAHI CHEMICAL IND (JP)  
 IPC: B01J23/14; C07B61/00; C07C68/06 (+8)
- 4 PROCESS FOR THE PREPARATION OF AROMATIC CARBONATES  
 Inventor: TOJO MASAHIRO (JP); OONISHI KAZUHIRO (JP); (+1)  
 EC: C07C68/06  
 Publication info: DE69814652T T2 - 2004-03-25  
 Applicant: ASAHI CHEMICAL IND (JP)  
 IPC: B01J23/14; C07B61/00; C07C68/06 (+8)
- 5 PROCESS FOR THE PREPARATION OF AROMATIC CARBONATES  
 Inventor: TOJO MASAHIRO (JP); OONISHI KAZUHIRO (JP); (+1)  
 EC: C07C68/06  
 Publication info: EP1016648 A1 - 2000-07-05  
 EP1016648 A4 - 2000-12-06  
 EP1016648 B1 - 2003-05-14  
 Applicant: ASAHI CHEMICAL IND (JP)  
 IPC: B01J23/14; C07B61/00; C07C68/06 (+8)
- 6 PROCESS FOR THE PREPARATION OF AROMATIC CARBONATES  
 Inventor: TOJO MASAHIRO (JP); OONISHI KAZUHIRO (JP); (+1)  
 EC: C07C68/06  
 Publication info: ES2198743T T3 - 2004-02-01  
 Applicant: ASAHI CHEMICAL IND  
 IPC: B01J23/14; C07B61/00; C07C68/06 (+8)
- 7 PRODUCTION OF AROMATIC CARBONATES  
 Inventor: TOJO MASAHIRO; ONISHI KAZUHIRO; (+1)  
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- 8 Process for producing aromatic carbonates  
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- 9 Process for producing aromatic carbonates  
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- 10 PROCESS FOR THE PREPARATION OF AROMATIC CARBONATES  
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Peroxy Compounds  
to  
Polyesters

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is less tough than the unsubstituted. However, the toughness of the methyl-substituted polycarbonate is better than that of polystyrene.

The bis(4-hydroxy-3,5-dimethylphenyl)methane (TMBPF) polycarbonate exhibits surprisingly high flame retardancy, although the polycarbonate consists only of C, H, and O, and has a high aliphatic content (126). Even for a sample of 0.8-mm thickness, the flame retardancy (UL 94) is classified as VO, and the oxygen index is 43%. It is more impact-resistant than TMBPA polycarbonate and can be mixed with bisphenol A polycarbonate (127), TMBPA polycarbonate, and styrene-acrylonitrile copolymers of a low acrylonitrile content to give a single phase (128).

**Blends.** The TMBPA polycarbonates can be mixed with bisphenol A polycarbonates to give a single phase (127). The transparent blends possess properties intermediate between those of the individual polycarbonates, depending on the ratio of components. A high proportion of TMBPA PC results in high heat-distortion resistance and stability to hydrolysis. A high proportion of BPA PC results in high impact strength and notched impact strength.

The heat-distortion resistance of blends of BPA PC and poly(alkylene terephthalate)s, eg, poly(butylene terephthalate)s, can be significantly increased by blending with TMBPA PC (129).

With poly(vinyl chloride), TMBPA PC gives transparent molecular disperse blends (130,131). The heat-distortion resistance is intermediate between those of the two polymers and depends on the amount of TMBPA PC present. TMBPA polycarbonate can be blended with polystyrene and styrene-acrylonitrile copolymers with a low acrylonitrile content (eg, 10%) to give a single-phase mixture (132-136).

The impact strength and notched impact strength of these blends can be increased by adding rubber modifiers (129,130,132,137). Because TMBPA PC has a low refractive index, transparent blends can be prepared from TMBPA PC with special HIPS or ABS grades, or with transparent rubber-modified PVC (130,133,138).

**Other Bisphenols.** The reaction of the three isomeric dihydroxybenzenes with phosgene in pyridine gives the simplest aromatic polycarbonates (139). Hydroquinone and resorcinol give low molecular weight polycondensates; pyrocatechol gives a cyclic monomeric carbonate. The resorcinol polycarbonate is glassy amorphous and melts at 200°C; the hydroquinone polymer is crystalline, insoluble, and infusible.

Industrially useful polycarbonates are formed from monomers of the bisphenol type (22,62,124,140) (Table 10), where two phenolic radicals in the *p*-position are bridged via C, O, S, or alkylene. Particularly important are the alkylidene and cycloalkylidene bisphenols, which are readily obtained by condensation of phenols with aldehydes or ketones.

Some bisphenols are used as homopolymeric additives in blends with bisphenol A polycarbonate (eg, oligomers based on tetrabromobisphenol A as a flame retardant) or they are subjected, as comonomers, to a copolymerization with bisphenol A, incorporated randomly as well as in the form of block copolymers.

**Copolyarbonates.** Copolyarbonates obtained from bisphenol A and tetrabromobisphenol A (TBBPA) exhibit flame retardancy. Polycarbonates based on tetrachlorobisphenol A (TCBPA) have no application.

Table 10. Aromatic Polycarbonates Derived from Bisphenols

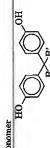
Monomer		Polycarbonate			
		Mp, °C	T <sub>g</sub> , °C	Melt range, °C	Special properties
					Refs.
					
R	R				
-H	-H	163	147	>300	cryst. insoluble
-CH <sub>3</sub>	-CH <sub>3</sub>	123	130	292-305	
-H	-H	123	133	185-195	
-H	-H	123	133	185-195	
-H	-H	155	149	195-170	
-H	-H	223-224	190	170-180	
-H	-H	221-222	198		141,142
-H	-H	207-208	207		141
-H	-H	161	121	200-215	22,124,140,141
-CH <sub>3</sub>	-CH <sub>3</sub>	157	159	220-230	22,124,140,141
-CH <sub>3</sub>	-CH <sub>3</sub>	125	134	205-220	22,124,140
-CH <sub>3</sub>	-CH <sub>3</sub>	149	137	200-220	22,124,140
-CH <sub>3</sub>	-CH <sub>3</sub>	188	176	210-230	22,124,140
-O-CH <sub>3</sub>	-O-CH <sub>3</sub>	206-208	149	175-195	62
-n-C <sub>4</sub> H <sub>9</sub>	-n-C <sub>4</sub> H <sub>9</sub>	155	148	190-200	22,124,140
-O-CH <sub>3</sub>	-O-CH <sub>3</sub>	160-161	142	200-220	62
-O-CH <sub>3</sub>	-O-CH <sub>3</sub>	285	121	175-200	high refractive index
-H	-H	255	220	210-230	high refractive index
-H	-H	202	189	~240	flame-retardant
-H	-H	220	220	dec	flame-retardant
-O-CH <sub>3</sub>	-O-CH <sub>3</sub>	214-215	168	230-260	flame-retardant, fibers
-O-CH <sub>3</sub>	-O-CH <sub>3</sub>	dec	180		147,148
-O-CH <sub>3</sub>	-O-CH <sub>3</sub>	161	149		144,149-151
-CN	-CN	170	200		152
-CN	-CN	147	196		152



Table 10. (Continued)

Monomer	M <sub>n</sub> , °C	T <sub>g</sub> , °C	Polycarbonate		Refs.
			Melt range, °C	Special properties	
	208 183-184 217	138	210-225 ~126	flame-retardant	22,124,140 153,154 155
	157	167	240-260		22,124,140
	190	179	250-260	high HDT	22,124,140,141
	200	224		high HDT	141
	221-223	256		high HDT	141
	224 275	366 275	~390		143,156,157
	262-263	270		OT = 38%	156,159
	316	290		OT = 65-75%	158
	280	250		OT = 38%	158

$\begin{array}{c} \text{---CH}_2\text{---CH}_2\text{---} \\   \\ \text{---CH}_2\text{---} \\   \\ (\text{CH}_2)_3\text{C---C(CH}_3)_2 \\   \\ \text{C}_6\text{H}_4 \end{array}$	199 140 141					290-300 195-160 210-230	cryst. insoluble	22,124,140 22,124,140 22,124,140
$\begin{array}{c} (\text{CH}_2)_3\text{C---C(CH}_3)_2 \\   \\ \text{C}_6\text{H}_4 \end{array}$	145					230-250		22,124,140
$\begin{array}{c} \text{H}_3\text{C} \\   \\ \text{H}_3\text{C}_2\text{---C---C}_6\text{H}_5 \\   \\ \text{H}_3\text{C}_2 \end{array}$	304					228		160
$\begin{array}{c} \text{---C---} \\   \\ \text{C}_6\text{H}_5 \end{array}$	213-215 197 319-521						photosensitizing photocross-linking photocross-linking	161 22,124,140,162 22,124,140,162
$\begin{array}{c} \text{---CH---CH---CO---} \\   \quad   \\ \text{OH} \quad \text{CH} \end{array}$	160 163 249					230-235 230-240 200-210		22,124,140 22,124,140,163 22,124,164
$\text{---SO---}$								
$\begin{array}{c} \text{biphenol structure} \\ \text{CH}_3 \quad \text{CH}_3 \\   \quad   \\ \text{HO---C}_6\text{H}_4\text{---CH}_2\text{---C}_6\text{H}_4\text{---OH} \\   \quad   \\ \text{H}_3\text{C} \quad \text{CH}_3 \end{array}$	175	185					flame-retardant <sup>b</sup>	47,165
$\begin{array}{c} \text{CH}_3 \quad \text{CH}_3 \\   \quad   \\ \text{HO---C}_6\text{H}_4\text{---CH}_2\text{---C}_6\text{H}_4\text{---OH} \\   \quad   \\ \text{CH}_3 \quad \text{CH}_3 \end{array}$	113	140				210-220		22,124,140
$\begin{array}{c} \text{H}_3\text{C} \quad \text{CH}_3 \\   \quad   \\ \text{HO---C}_6\text{H}_4\text{---CH}_2\text{---C}_6\text{H}_4\text{---OH} \\   \quad   \\ \text{CH}_3 \quad \text{CH}_3 \end{array}$	137	126						47

Table 10. (Continued)

Monomer $\text{CH}_2=\text{CHCH}_2$	$M_p$ , °C	$T_g$ , °C	Polycarbonate Melt range, °C	Special properties	Refs.
				cross-linking	166
	91	147	190-210	gas barrier	22,124,140
	166	207		hydrolytically stable	47
	133	280	280-290	flame-retardant, fibers	22,124,140,148
	178-180	265		flame-retardant	22,124,140,148
	238-340	303		flame-retardant	166

	189		gas barrier	167
	202	213		47
	183-184	280	flame-retardant, fibers high HDT	141
		210		47
	180	265		188
		250		169
		46	clearance, glass substrate	170

<sup>a</sup> Bisphenol F.  
<sup>b</sup> Bisphenol A.  
<sup>c</sup> Oxygen index.  
<sup>d</sup> Bisphenol D.  
<sup>e</sup> Bisphenol Z.  
<sup>f</sup> TBCA.  
<sup>g</sup> TBCEA.  
<sup>h</sup> TBCEA.  
<sup>i</sup> TBCEA.

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